

CLAIMS

We Claim:

1. A re-configurable channel dropping de-multiplexer, comprising:
 - an input;
 - 5 a first polarizing port optically coupled to the input;
 - a first polarization modulator optically coupled to the first polarizing port;
 - a polarization beam splitter (PBS) having a first side that is optically coupled to the first polarization modulator at a side opposite to the first polarizing port;
 - 10 a second polarization modulator optically coupled to the PBS at a second side of the PBS that is opposite to the first side;
 - a second polarizing port optically coupled to the second polarization modulator at a side opposite to the PBS; and
 - a multiple-channel output optically coupled to the second polarizing port.
2. The de-multiplexer of Claim 1, further comprising a first quarter-wave ($\lambda/4$) plate optically coupled to the PBS at a third side of the PBS that is not parallel to either of the first two sides.
- 15 3. The de-multiplexer of Claim 2, further comprising a second $\lambda/4$ plate optically coupled to the PBS at a fourth side of the PBS that is opposite to the third side and a mirror optically coupled to the second $\lambda/4$ plate at a side opposite to the PBS.

4. The de-multiplexer of Claim 3, further comprising an optical channel band pass filter optically coupled to the first $\lambda/4$ plate at a side opposite to the PBS.

5. The de-multiplexer of Claim 4, further comprising a third $\lambda/4$ plate optically coupled to the optical channel band pass filter at a side opposite to the first $\lambda/4$ plate.

5 6. The de-multiplexer of Claim 5, further comprising:
a third polarizing port optically coupled to the third $\lambda/4$ plate at a side opposite to the optical channel band pass filter; and
a single-channel output optically coupled to the third polarizing port.

7. The de-multiplexer of Claim 6 functioning in a first operational state, wherein the
10 first and the second polarization modulators are configured so as to rotate the orientation of plane polarized light by 90 degrees; and wherein the input receives and directs a plurality of optical channels to both the second polarizing port and the third polarizing port such that a single dropped channel is routed to the third polarizing port and such that the remaining express channels are routed to the second polarizing port.

15 8. The de-multiplexer of Claim 6 functioning in a second operational state, wherein the first and the second polarization modulators are configured so as to not change the polarization plane orientation of plane polarized light; and wherein the input receives and directs a plurality of optical channels to the second polarizing port and no optical channels are directed to the third polarizing port.

9. The de-multiplexer of Claim 1, further comprising an isolator core optically coupled to the PBS at a third side of the PBS that is not parallel to either of the first two sides.

10. The de-multiplexer of Claim 4, wherein the optical channel band pass filter comprises a thin film band pass filter.

5 11. The de-multiplexer of Claim 5, operating as a channel adding multiplexer, wherein the multiple-channel output serves as a multiple-channel input for receiving a plurality of express channels, the single-channel output serves as a single-channel input, the input serves as an output, and the multiple-channel input is combined with the single-channel input to the output.

10 12. A re-configurable channel dropping de-multiplexer, comprising:
an input;
a first polarizing port optically coupled to the input;
a first polarization modulator optically coupled to the first polarizing port;
a polarization beam splitter having a first side s1 that is optically coupled to the
15 first polarization modulator at a side opposite to the first polarizing port;
a second polarization modulator optically coupled to the PBS at a side s3 of the
PBS that is not parallel to the first side s1;
a second polarizing port optically coupled to the second polarization modulator at
a side opposite to the PBS 102; and
20 a multiple-channel output optically coupled to the second polarizing port.

13. The de-multiplexer of Claim 12, further comprising a first quarter-wave ($\lambda/4$) plate optically coupled to the PBS at a side s2 of the PBS that is opposite to the first side s1.
14. The de-multiplexer of Claim 13, further comprising:
- a second $\lambda/4$ plate optically coupled to the PBS at a side s4 of the PBS opposite to the side s3; and
- a mirror optically coupled to the second $\lambda/4$ plate at a side opposite to the PBS.
15. The de-multiplexer of Claim 14, further comprising:
- an optical channel band pass filter optically coupled to the first $\lambda/4$ plate at a side opposite to the PBS;
- a third $\lambda/4$ plate optically coupled to the optical channel band pass filter at a side opposite to the first $\lambda/4$ plate;
- a third polarizing port optically coupled to the third $\lambda/4$ plate at a side opposite to the optical channel band pass filter; and
- a single-channel output optically coupled to the third polarizing port.
16. The de-multiplexer of Claim 15 operating in a first state, further comprising a plurality of optical channels $\lambda_1-\lambda_n$ passing through the re-configurable channel dropping de-multiplexer from the first polarizing port to both the second polarizing port and the third polarizing port such that a single dropped channel λ_d is routed to the third polarizing port and the remaining express channels are routed to the second polarizing port.

17. The de-multiplexer of Claim 15 operating in a second state, further comprising a plurality of optical channels λ_1 - λ_n passing through the re-configurable channel dropping de-multiplexer wherein all the channels are routed to the second polarizing port.

18. A re-configurable channel dropping de-multiplexer, comprising:

- 5 an input;
- a first polarizing port optically coupled to the input;
- a first polarization modulator optically coupled to the first polarizing port;
- a polarization beam splitter (PBS) having a first side that is optically coupled to the first polarization modulator at a side opposite to the first polarizing port;
- 10 a second polarization modulator optically coupled to the PBS at a second side of the PBS that is opposite to the first side;
- a second polarizing port optically coupled to the second polarization modulator at a side opposite to the PBS;
- a multiple-channel output optically coupled to the second polarizing port; and
- 15 an isolator core optically coupled to the PBS at a third side of the PBS that is not parallel to either of the first two sides.

19. A cascaded re-configurable system having two or more re-configurable channel dropping de-multiplexers, comprising:

- 20 a first re-configurable channel dropping de-multiplexer, comprising:
 - an input for receiving a plurality of channels;
 - a first polarizing port optically coupled to the input;

- a first polarization modulator optically coupled to the first polarizing port;
 - a polarization beam splitter (PBS) having a first side that is optically coupled to the first polarization modulator at a side opposite to the first polarizing port;
 - a second polarization modulator optically coupled to the PBS at a second side of

5 the PBS that is opposite to the first side;

 - a second polarizing port optically coupled to the second polarization modulator at a side opposite to the PBS; and
 - a multiple-channel output optically coupled to the second polarizing port; and
 - a second re-configurable channel dropping de-multiplexer, optically coupled to the first

10 re-configurable channel dropping de-multiplexer, comprising:

 - an input, coupled to the multiple-channel output of the first re-configurable channel dropping de-multiplexer;
 - a first polarizing port optically coupled to the input;
 - a first polarization modulator optically coupled to the first polarizing port;

15 a polarization beam splitter (PBS) having a first side that is optically coupled to the first polarization modulator at a side opposite to the first polarizing port;

 - a second polarization modulator optically coupled to the PBS at a second side of the PBS that is opposite to the first side;
 - a second polarizing port optically coupled to the second polarization modulator at

20 a side opposite to the PBS; and

 - a multiple-channel output optically coupled to the second polarizing port.